DETERMINING REPLACEMENT VALUE OF TREES AND SHRUBS IN ALBERTA

a guide to assist professionals

Alberta

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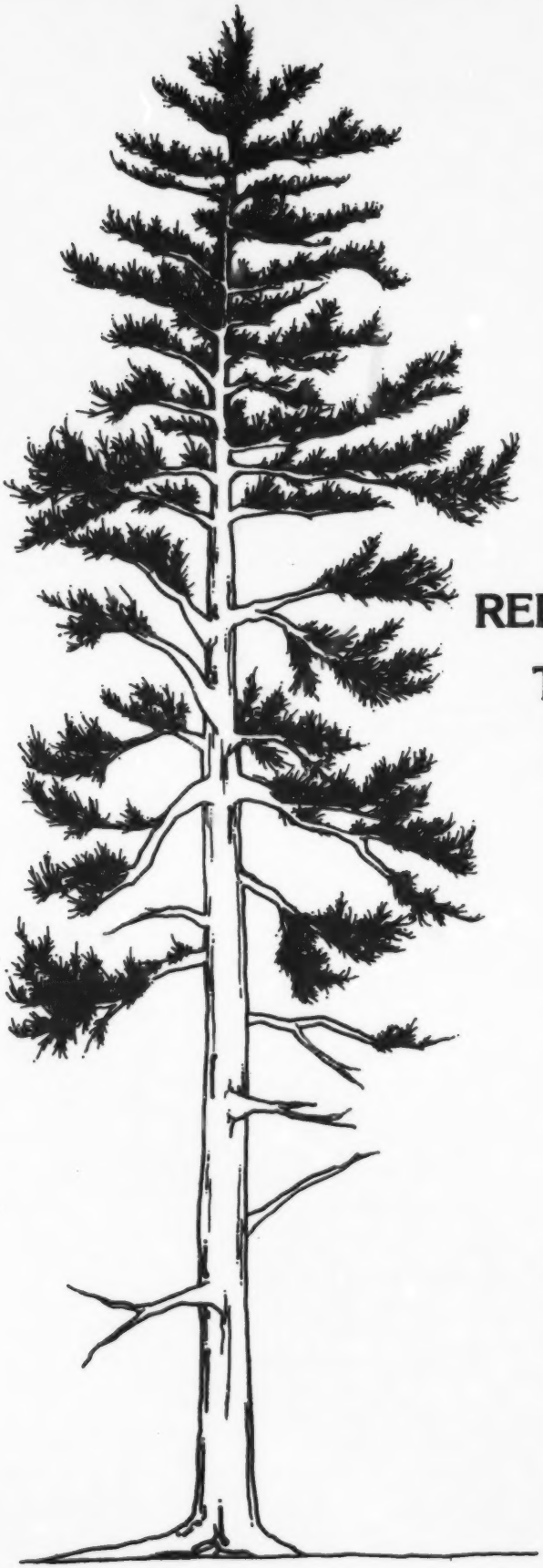

DETERMINING REPLACEMENT VALUE OF TREES AND SHRUBS IN ALBERTA

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ACKNOWLEDGEMENTS

This publication has been prepared to provide guidelines for establishing values for trees and other plants in Alberta. Many professionals have contributed to the concept of evaluating plants. *The Shade Tree Evaluation Guide* was first printed in 1947. The council of Tree & Landscape Appraisers completed a fourth revision in 1979.

This publication is a supplement (for use in Alberta) to the booklet *Guide for Establishing Values of Trees and Other Plants*. That booklet is available from ISA (International Society of Arboriculture) P.O. Box 71, 5 Lincoln Square, Urbana, Illinois 61801.

Thanks and appreciation are extended to the committee which rated Alberta stock and gave other invaluable assistance. Prof. H. Knowles, Prof. of Horticulture, University of Alberta; Mr. R. Nyroos, Arborist, City of Edmonton; Mr. B. Casement, Research Scientist, Alberta Horticultural Research Center, Brooks, Alberta; and Mr. H. Oosterhuis, Tree Planting Supervisor, Alberta Tree Nursery and Horticulture Centre, Edmonton.

INTRODUCTION

Trees, individually and collectively, have many functional and aesthetic values. The objective of this publication is to provide (1) a method by which a plant or plants can be examined to determine a realistic value, (2) consulting arborists and professional horticulturists with a system for assessing natural casual losses, (3) a means of appraising damage due to accidental or intentional trespassing, and (4) information to be used by cities to evaluate urban trees.

Species, size and physical condition are the basic factors considered in appraising plants.

Traditionally, the primary value of trees and other landscape plants has been focused on their aesthetic qualities and beauty. Such qualities are difficult to quantify. However, trees and other landscape plants have assets beyond their aesthetic value. Plants are living objects; they are engaged in the most profound creativity in the world and, because of their ability to photosynthesize, they are essential to all mankind.

Shade trees and other landscape plants are used as planting elements for architectural, engineering, aesthetic, and climatic control purposes. Noise abatement, atmospheric purification, traffic control and controlling glare and reflection are some of the engineering uses of the plants. Solar radiation, wind, temperature, and precipitation modification are among the climatological uses of plants. Other considerations, such as timber value, fruit and nut production, as well as contributions to wildlife habitat and recreational activity, may be relevant in certain cases.

Trees and other landscape plants enhance property values and increase a city's assets.

Professional arborists and horticulturists should continually emphasize the functional value of plants. Trees have to be evaluated as part of a functional unit rather than as a unit on their own.

It is generally considered that "land" is made up of various components including soil, grass cover, water (if present), trees and other plants growing thereon, and any buildings that may be present. The value of the "land" as a whole can be legitimately calculated only by an appraisal of its various components. Since trees and other plants are often a major component of the land and add value to it, the evaluation of the plant material can only be achieved by an experienced professional arborist or horticultural appraiser.

This evaluation guide is divided into three sections. One section deals with specimen trees and plants found in the landscape, and includes trees in parks, arboretums and other public areas. The second section deals with trees in shelterbelts (windbreaks) and other woodland or forested areas. The third section deals with replanting native sites with a variety of plants.

Figure 1. In a buffer zone, such as the one illustrated, a value is placed on the functional use of trees and shrubs.

GENERAL CONSIDERATIONS TO APPRAISAL

Any means or formula for evaluating shade trees must be flexible. No hard and fast rules can be set that will hold in all cases. Instances undoubtedly will be encountered of such remarkable specimens that the basic value might be higher than usual. This is a matter for the appraiser's judgment as is the **condition class** for any tree.

The appraiser must decide whether it is desirable to consider matters not included in the formula, such as the effect of land value or any other factor believed to influence the value of the particular tree. The judgment and opinion of the appraiser will always be important in determining the value. An arborist or horticulturist familiar with the characteristics of the trees being appraised, through experience with trees in landscape plantings, and who is capable of placing individual specimens in their proper classification and condition classes, must make the appraisal.

The lists of Trees of Alberta (Appendix I) prepared by the authors are not "all inclusive" nor are they the final word. Changes and upgrading will be necessary in order to keep abreast of the many cultivars and new plant introductions. There are many cultivars and even some species that have not been included because of the lack of sufficient data for proper classification. In most cases cultivars of species were not classified. Consequently, the proper classification of the cultivars of several genera, such as *Populus* and *Salix*, is left to the judgment of the qualified arborist or horticulturist confronted with the appraisal.

This evaluation guide makes use of two methods to enable the professional arborist to establish a monetary value for a tree: (1) replacement and (2) a basic formula geared to a monetary value per sectional square centimetre of trunk diameter. The replacement and basic formula values are subjected to various percentage evaluations for species, condition, and location. The monetary unit established must be flexible to allow for changes in the value of the dollar and known costs of conducting horticultural practices.

SECTION ONE — SPECIMEN TREES AND SHRUBS — REPLACEMENT VALUE

Most small trees have a replacement value. It is suggested that when a definite replacement value can be established for a particular tree that this be used. For medium and large shade trees where a replacement value is impractical, the basic formula method, which will be described, is more practical.

It should be understood that this method for evaluating shade and ornamental trees is intended for use with specimen trees in landscape designs or street plantings rather than for park and forested areas. Unrealistic values may be obtained by applying it to trees in group plantings. For example, a group of three trees growing close together might be of no more value to the landscape than one single specimen tree. When used on trees growing in groups, the appraiser will need to introduce a percentage factor, based on his judgment, by which the values of the individual trees of the group should be reduced. The same procedure may be necessary in dealing with trees having multiple trunks, although in a particular landscape design a multiple-stemmed tree may be especially desirable and have full or extra value.

For trees in parks reasonable values can be established by the basic formula method. The formula can be found in the booklet available from the International Society for Arboriculture. (See acknowledgements) Because the area is a park, trees are definitely worth more than their timber value. In this instance, experienced people must select a percentage factor that in their opinion represents the difference in value of the particular park trees and that specified by the use of the formula. It is quite possible that a lawn specimen tree may have a different value from a street tree because of its low branching habit, or it may have had better maintenance producing a better structure or a healthier plant.

Figure 2. In a park setting the value of an individual tree growing in a group may be less than that of a single tree by itself.

Usually the appraiser can establish replacement values through actual quotations from local nurserymen, landscape contractors, or by reference to nursery catalogues. Where no values for specific species or cultivars can be established, the appraiser may be forced to use prices listed for plants of similar kind and size.

If replacement costs must be computed, such factors as tree or plant cost, availability, labor costs, special area problems, the cost of removing the casualty trees or plants, restoration of the casualty area, guarantees, maintenance and other unusual conditions or problems, as well as profit, must be considered. Transportation distances may make replacement costs excessive.

Table 1 has been prepared to aid the appraiser in establishing values for transplanting-size trees in areas where difficulty is experienced in obtaining cost estimates. Replacement cost estimates were based on the following specifications: "cost to include cost of the plant, properly sized, guaranteed for one year, guyed, wrapped and otherwise treated according to standard arboricultural practices."

Standards state that the caliper of the trunk shall be taken 15 cm above ground level up to and including 10 cm caliper size, and 1.5 m above ground level for larger sizes. These positions of caliper measurement conform to the usual bidding specifications for purchase contracts and planting cost calculations by landscape architects, landscape contractors, and arborists.

Replacement costs of trees are subject to many variables, including labor costs, availability of planting stock and site variations, and factors prevailing in different parts of the country. These variables necessitate a spread in the estimated replacement costs. Currently, most estimates will fall within the range or within 10 to 15 percent of the range indicated in Table 1. However, local replacement costs should prevail. The figures in Table 1 may apply to both deciduous and evergreen trees, especially in the larger sizes. Costs of evergreen trees of the smaller caliper sizes are usually calculated on a height basis.

TABLE 1
AVERAGE REPLACEMENT COST OF TREES

*Trunk Caliper in Centimetres (inches)	Basic Replacement Cost (1985$)
5.0 (2)	180 — 200
7.5 (3)	240 — 320
10.0 (4)	340 — 480
12.0 (5)	540 — 710
15.0 (6)	730 — 840
17.5 (7)	900 — 1050

*Measurements: To 10 cm caliper, taken 15 cm above ground level; 11 cm and more in caliper, taken 1.5 m above ground level.

Replacing a tree beyond this size would be by mechanical means and involves such high moving costs that they have been deleted from this list. The moving costs may exceed the value of a tree and make the dollar cost unrealistic. Therefore, replacement should be used only for trees of 5 - 17.5 cm.

One may be entitled to full remuneration of replacement cost for a casualty. Allowances should be subject to species, condition, and location factors. For example, if a low rating tree species in poor physical condition becomes a casualty during a storm, one should not expect full remuneration or replacement. A qualified professional horticulturist will be capable of making the proper adjustment.

The use of the basic formula method in tree appraisal depends upon field inspection and complete diagnosis of the tree or trees involved. Field records and photographs are important. Leave no details to memory. The Council of Tree and Landscape Appraisers has prepared an illustrated field report folder for recording field data as a model.

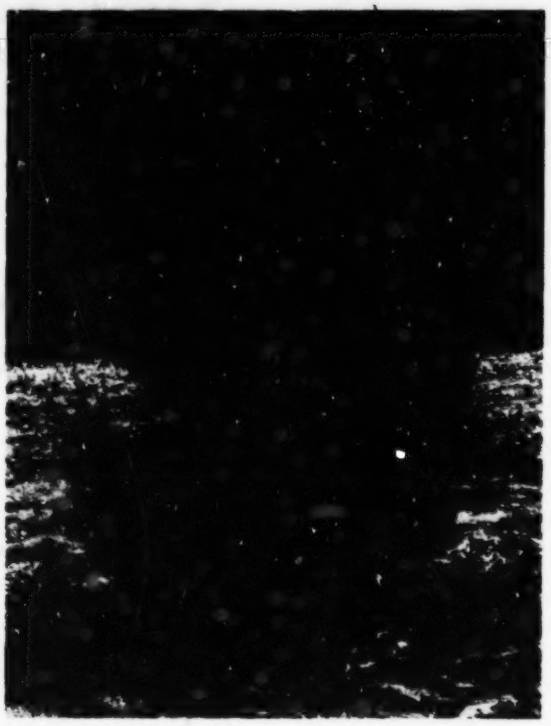


Figure 3. Trees and shrubs grown as specimen plants for arboreta are of very high value as feature plants.

TABLE 2
BASIC EVALUATION OF TREES CALCULATED ON CROSS-SECTION AREA OF TRUNK

			(0.7854 d^2) X 3.90							
Trunk Caliper (cm)	Cross Sectional Area cm^2	Basic Value * $$$	Class Special 110%	Class I 100%	Class IIA 90%	Class II 80%	Class IIIA 70%	Class III 60%	Class IVA 50%	Class IV 40%
5	19.6	76	84	76	68	61	53	46	38	30
7	38.5	150	165	150	135	120	105	90	75	60
9	63.6	248	273	248	223	198	174	149	124	99
11	95.0	370	409	370	333	296	259	222	185	148
13	132.7	517	569	517	465	414	362	310	259	207
15	176.7	689	758	689	620	551	482	413	345	276
17	227.0	885	974	885	797	708	620	531	443	354
19	283.5	1106	1217	1106	995	885	774	664	553	442
21	346.4	1351	1486	1351	1216	1081	946	810	676	540
23	415.5	1620	1782	1620	1458	1296	1134	972	810	648
25	490.9	1915	2107	1915	1724	1532	1341	1149	958	766
27	572.6	2233	2456	2233	2010	1786	1563	1340	1117	893
29	660.5	2576	2834	2576	2318	2061	1803	1546	1288	1030
31	754.8	2944	3238	2944	2650	2355	2061	1766	1472	1178
33	855.3	3336	3620	3336	3002	2669	2335	2002	1668	1334
35	962.1	3752	4127	3752	3377	3002	2626	2251	1876	1501
37	1075.2	4193	4612	4193	3774	3354	2935	2516	2097	1677
39	1194.6	4659	5125	4659	4193	3727	3261	2795	2330	1864
41	1320.3	5149	5664	5149	4634	4119	3604	3089	2575	2060
43	1452.2	5664	6230	5664	5098	4531	3965	3398	2832	2266
45	1590.4	6203	6823	6203	5583	4962	4342	3722	3102	2481
47	1734.9	6766	7443	6766	6089	5413	4736	4060	3383	2706
49	1885.8	7355	8091	7355	6620	5884	5149	4413	3678	2942
51	2042.8	7969	8766	7969	7172	6375	5578	4781	3985	3188
53	2206.2	8604	9464	8604	7744	6883	6023	5162	4302	3442
55	2375.8	9266	10193	9266	8339	7413	6486	5560	4633	3706
57	2551.8	9952	10947	9952	8957	7962	6966	5971	4976	3981
59	2734.0	10663	11729	10663	9597	8530	7464	6398	5332	4265
61	2922.5	11398	12538	11398	10258	9118	7979	6839	5699	4559
63	3117.3	12157	13373	12157	10941	9726	8510	7294	6079	4863
65	3518.3	13721	15093	13721	12349	10977	9605	8233	6861	5488
67	3525.7	13750	15125	13750	12375	11000	9625	8250	6875	5500
69	3739.3	14583	16041	14583	13125	11666	10208	8750	7292	5833
71	3959.2	15441	16985	15441	13897	12353	10809	9265	7721	6176
73	4185.4	16323	17955	16323	14691	13058	11426	9794	8162	6529
75	4417.9	17230	18953	17230	15507	13784	12061	10338	8615	6892
77	4656.6	18161	19977	18161	16345	14529	12713	10897	9081	7264
79	4901.7	19117	21029	19117	17205	15294	13382	11470	9559	7647
81	5153.0	20097	22107	20097	18087	16078	14068	12058	10049	8039
83	5410.6	21101	23211	21101	18991	16881	14771	12661	10551	8440
85	5674.5	22131	24344	22131	19918	17705	15492	13279	11065	8852
87	5944.7	23184	25502	23184	20866	18547	16229	13910	11592	9274
89	6221.2	24263	26689	24263	21837	19410	16984	14558	12132	9705
91	6503.9	25365	27902	25365	22829	20292	17756	15219	12683	10146

*Calculated on $3.90 per square centimetre of cross-section trunk area at: 15 cm height up to 10 cm diameter and 1.5 m above the ground or as near as possible to that height for larger sizes. All dollar values are rounded to the next full dollar.

PLANT EVALUATION

TREES

In determining the monetary value of shade and ornamental trees, four factors must be considered. These are size, kind, condition, and location of the trees.

Size

Tree size can be designated in several ways, such as the diameter of the trunk, the area of a cross-section of the trunk, the height, the branch spread, or a combination of all or a part of these measurements. The area of the cross-section of the trunk at a point 1.5 metres above the ground, or as near this height as possible, is the best means of expressing the size of shade trees when a value related to size is to be determined. This cross-section trunk area can easily be calculated from the trunk caliper using the formula 0.7854 d^2, d^2 is diameter squared in centimetres. These calculations have been made for trees with trunk calipers ranging from 5 cm to 91 cm. (See Table 2).

Basic Formula:

Shade & Ornamental Trees

The basic formula method is used for trees over 30 cm in diameter. It is realized that there is a "gray area" in the differentiation of trees into sizes indicating whether they can be transplanted or not. Certain caliper trees may be placed in either the replacement or the basic formula categories. The use of either method of appraisal may reflect either high or low values. In such cases, the appraiser may average out the values obtained by using both methods of appraisal or select the one he decides is the most fair and reasonable based on sound procedural techniques. *The replacement method should take precedence over the basic formula method wherever possible.*

A value of $3.90 per square centimetre (1985$) of trunk cross-section has been given as a conservative value of a perfect specimen shade tree. No price set upon a tree will remain constant for all time since the value of our dollar varies with economic conditions. For convenience, the basic value for each centimetre of trunk caliper has been calculated and listed in Table 2.

Not all species and varieties of trees are of equal value.

The largest percentage of trees for which appraisals will be required in Alberta will be below 60 cm.

Classification calculations are listed at 10% intervals. The user should understand that any interval can be used. The authors used this broad range to group a large number of species.

Multiple Trunk Trees

Several methods have been employed to determine values of multiple trunk trees. The most common method is to compute the value based on the diameter of the main (largest) trunk plus 40 - 60% of the value derived from the combined diameters of the remaining trunks.

Values determined by the canopy method do not take into consideration the aesthetic value of the multiple trunks and the bark characteristics. The appraiser must consider how well the specimen satisfies the requirements of the given situation before the appraisal is made. Location, environment and aesthetic values are factors to consider.

Basic formula for a 3 stem multiple trunk tree would then be (all measurements in centimetres):

$A^2 + ((B^2 + C^2) \times 40 - 60\%) \times \$3.40 =$ Basic Value

A^2 = Cross-sectional area of main stem

$B^2 + C^2$ = Cross-sectional area of secondary stems

Species

There will be disagreement as to the rating given any species or cultivar. These differences may include such factors as relative hardiness, structural strength, durability and life expectancy, cleanliness, resistance to insects and diseases, and environmental and aesthetic value. Hardiness is considered a most important point in species rating, but usually in appraisal work the plant will not be present unless it is hardy.

Site adaptability is an important factor in species rating. For example, *Tilia cordata*, Little Leaf Linden, is

Damage to individual trees from construction should be compensated for.

an excellent lawn tree for most residential areas but it is not well adapted to industrial areas and thus would have a different species rating in the two sites.

Qualified professional arborists and horticulturists, familiar with the characteristics and environmental adaptabilities of trees and other plants are able to determine the correct species classification. Percentage ratings depend on many factors, some extremely local. Ratings based on zone cold-hardiness alone are often misleading.

Species and cultivar rating can be any percentage from 1 to 110 percent. A tree of high value (80 - 110%) will possess the qualities of hardiness, reasonable durability, and wide adaptability. It will require little maintenance and is free from undesirable characteristics. It should possess a sturdy branching habit and pleasing foliage, and may have the added features of interesting flowers or fruits.

The *Alberta Horticultural Guide* and similar publications will aid in the determination of recommended trees, shrubs and evergreens for use in Alberta.

The value of a commercial landscape is determined by the design and material used.

Condition

Very few trees or shrubs are perfect specimens. A qualified professional plant person able to recognize and quantify the tree or plant condition and relate it to a perfect specimen is required.

As trees reach maturity they often develop structural weaknesses or other physical defects. Crowded, overgrown plants may fail to satisfy the requirements of a given landscape situation. Such specimens may even have a negative value and would improve aesthetic and functional values if removed.

Annual growth rate, extent of decay, structural weakness, freedom from insects and disease, ability to survive, and life expectancy of the plant or plants are factors to consider in determining the condition rating. Complete diagnosis of the physical condition of the plant is important.

The condition rating can be expressed as a percent (1 - 100).

TABLE 3
CONDITION RATING AS RELATED TO LIFE EXPECTANCY

Condition	Life Expectancy *(Years)	Percentage Rating
Excellent	Over 30	90 — 100
Good	20 — 30	80 — 90
Fair to good	15 — 20	60 — 80
Fair	10 — 15	40 — 60
Poor to fair	5 — 10	20 — 40
Poor, rapid decline	0 — 5	0 — 20

*Years beyond year of inspection.

The determination of the life expectancy is flexible and is based on the judgment of the appraiser. The severity of the defect, the type of fault and the consequences of the problem continuing are fundamental to the determination.

Injury can occur to the roots, trunk or crown of the tree. Earth fills, trenching, even toxic gases can injure roots; people and cars are some of the causes of trunk injury, and storms may result in broken branches reducing crown extent and condition. Where injury occurs, the appraiser will first evaluate the tree as it was prior to the injury. Then the extent of the injury will be established and expressed as a percentage of the total value.

Extent of root injury from cuts and fills and toxic gases may be difficult to establish, but here again, the knowledge of the expert becomes important. The extent of injury to trunk and cambium is not difficult to determine. It should be remembered that lengthwise trunk injuries are not as serious as those extending around the trunk. Consequently, it is necessary to consider the breadth of the injury in relation to the total circumference of the trunk (Table 4). Rate of wound healing varies with the different kinds of trees and is a factor to consider.

Extent of crown injury by missing, broken, or otherwise injured branches can be fairly accurately estimated. Several points need to be considered. First, the ability of the plant to develop a new crown or replace a portion of its crown. Second, the effect of age on the rate of crown redevelopment. A third point to consider is the cost and extent of corrective pruning necessary to improve and extend the life expectancy of the tree and its aesthetic and functional values.

TABLE 4
DIMINUTION IN VALUE AS RELATED TO PARTIAL INJURY*

Bark and cambium injury % of total trunk circumference	Reducing value by percent
Up to 20	At least 20
25	25
30	35
40	70
45	90
50	100

*Percentages taken from Table 7, page 322, *Tree Ecology and Preservation* by A. Bernatzky. 1978

Trees of the same type grown as boulevard trees, as shown, will probably have a lower value than if grown alone in a park.

TABLE 5
GUIDE FOR JUDGING THE CONDITION OF A SHADE TREE

Factor	Condition[1]	Points Awarded
Trunk condition	Sound and solid (5) Sections of bark missing (3) Extensive decay (1)	_____
Growth rate	More than 15 cm twig elongation (3) 5 - 15 cm twig elongation (2) Less than 5 cm twig elongation (1)	_____
Structure	Sound (5) One major or several minor limbs dead (3) Two or more major limbs dead (1)	_____
Insects and diseases	No pests present (3) One pest present (2) Two or more pests present (1)	_____
Crown development	Full and balanced (5) Full but unbalanced (3) Unbalanced and lacking a full crown (1)	_____
Life expectancy	Over 30 years (5) 15 - 20 years (3) Less than 5 years (1)	_____
	TOTAL POINTS	_____

[1] Number points awarded in parenthesis.

Total Points	Condition Class	Formula Percentage for Condition
26 — 23	Excellent	80 — 100
22 — 19	Good	60 — 80
18 — 14	Fair	40 — 60
13 — 10	Poor	20 — 40
9 — 6	Very Poor	0 — 20

Location

Location is the factor that takes into account site, function, position, and aesthetic value.

(1) Site: the relationship of the tree to its surroundings.

(2) Function: benefits the plant provides such as wind, noise, and temperature control.

(3) Position: where situated, boulevard, front lawn, shelterbelt, etc.

(4) Aesthetic value: the value of the plants' characteristics, such as flowers, foliage color or type, fruit and bark characteristics.

There will be overlap between species and location. Flowers may be a characteristic of the species but because of its location flowers may add or detract from the value of the specimen.

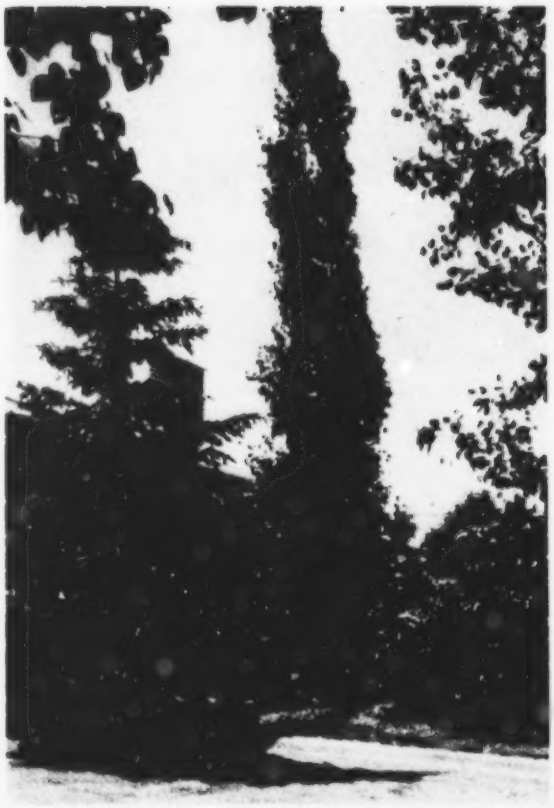
The location factor will allow the qualified professional horticulturist to consider the importance of the tree or trees from an architectural, engineering, climatic, and aesthetic viewpoint. Architecturally, trees may function to articulate space, soften architectural structure, provide privacy and screen unsightly views or objects, or emphasize off-site views. Air filtration through absorption of dirt and dust, purification of the atmosphere by emission of oxygen, noise abatement, lightning protection, preventing glare and reflection, prevention of soil erosion by wind and water, traffic direction, screening ski slopes to prevent snow melting, and use in preventing snow drifting may be classified as engineering functions of trees and other plants.

The appraiser should not overlook the aesthetic aspects and other quality values which, traditionally, have been considered of major importance. Branching habit, bark characteristics, foliage effects, flower and fruit characteristics may all add to the aesthetic value of trees. Trees may also furnish food and fibre for man and wildlife, and decrease mental stress. Thus, the location factor measures the "benefits" derived from the plants. The functional purposes served by plants in controlling environmental quality may be measured and, in fact, have been measured by scientists over the years.

The functional capabilities of trees become all-important in appraisals. The location of any tree or group of trees is a determining factor in evaluation. Trees growing in unimproved or natural wooded areas have a different value from trees on improved property. Street trees, park trees, and trees in recreational areas have a completely different set of values from those growing on improved residential property. A single tree on a residential property has greater value than an individual tree in a group.

Balance and concept of the landscape design should be considered in assessing tree values. The loss of a single tree in a formal design may destroy the effectiveness of the whole design.

The growth potential should be considered in the evaluation process. Will the size of the tree in a few years interfere with overhead or underground utility facilities?



Two high value lawn specimen trees.

TABLE 6
EVALUATION OF TREE LOCATION

Location	Percentage Rating
Feature or historical trees (Arboretum)	90 — 100
Average residential, landscape trees	80 — 90
Malls	75 — 85
Public and commercial area trees	70 — 80
Park trees	60 — 80
Golf course trees, strategically located	60 — 80
City streets and boulevards	60 — 80
Screen and windbreak trees**	60 — 70
Recreational and picnic area trees	60 — 70
Industrial area trees	50 — 70
Out of city highway trees	40 — 60
Native, open woods trees*	30 — 40
Dense forest trees*	10 — 20

*Does not include areas under forest management.
**Screen and shelterbelt trees are considered in more detail in a following section.

Small evergreens in such locations have a high value.

SHRUBS & SMALL EVERGREENS

The evaluation of shrubs and small evergreens is somewhat different from that for trees. Consideration must be given to the overall landscape design of the property and the functional value of the plants in respect to such factors as traffic articulation, privacy screening, noise abatement, and climate control. Also the aesthetic values of such plants should not be ignored.

Street trees such as these should be given a high value because of function performed.

The following steps are basic in this evaluation process. The factor selected in each case is a percentage of the wholesale value of nursery or garden centre stock available. Particular species or cultivars must be used.

Wholesale prices for deciduous shrubs and small evergreens are so variable that it is impossible to establish average prices that will give realistic replacement costs. With many deciduous shrubs it is possible to rejuvenate damaged plants by the total removal of all top growth.

Location

Table 7 may be considered as a guideline for evaluating site and functional values of specimen shrubs and small evergreens in various locations.

TABLE 7
GUIDELINES FOR EVALUATING SITE AND LOCATION FOR SPECIMEN SHRUBS AND SMALL EVERGREENS

Site — Location	Percent of Basic Value
Foundation Plantings	90 — 100
Specimen plants properly located in a functional landscape design	80 — 100
Plants for screen or windbreak purposes	60 — 80
Plants overgrown or with little functional or aesthetic value	20 — 60

Age

Using Table 8 attach a maturity factor to the assembly of values.

TABLE 8

Stage of Maturity	Age %
Mature size	100
To ¾ mature size	70
To ½ mature size	40
To ¼ mature size	15

Determining the anticipated life of trees may influence the final value. The trees shown are not long-lived and are past their peak of maturity.

Condition

TABLE 9

Condition of the plant	Condition %
Perfect Specimen	100
Good	90
Fair to Good	80
Fair	60
Poor to Fair	40
Poor	20

Planting Cost

1. Basic Evaluation

The planting cost is the estimation of planting time given by competent people under existing horticulture practices.

The evaluation is then:
Wholesale Cost X Species % X Location % X Age % X Condition % = Value + Planting Cost = Appraised Value $.

Typical Example: A *Cornus sericea* judged to be mature.

1.	Current wholesale value (45 cm branches)		$ 8.50
2.	X Species value %	X	50 %
			$ 4.25
3.	X Location %	X	100 %
			$ 4.25
4.	X Age %	X	60 %
			$ 2.55
5	X Condition %	X	100 %
			$ 2.55
6.	+ Realistic planting cost in $	+	$20.00
	APPRAISED VALUE		$22.55

Foundation plantings are frequently given a very high value.

2. Value Deducted Evaluation (An Alternative Method)

Use Table 10 to arrive at a figure for the value of a fully mature perfect specimen. Maximum value (100%) is given to *Pinus mugo* "dwarf" and *Picea pungens* "dwarf". This value is then used as the wholesale cost.

The percentages are taken of that value. The value then is higher but perhaps more useful especially when the replacement seriously reduces the property value.

The evaluation is then:
Basic Value X Species Value % X Age % X Condition % X Location % + Realistic Planting Cost.

The example: *Cornus sericea*

1.	Basic value		$50.00
2.	X Species value %	X	50 %
			$25.00
3.	X Location %	X	100 %
			$25.00
4.	X Age %	X	100 %
			$25.00
5.	X Condition %	X	60 %
			$15.00
6.	+ Realistic planting cost in $	+	$35.00
	APPRAISED VALUE		$50.00

A screen planting must be assessed for the functional value as well as the aesthetic.

TABLE 10
SPECIES EVALUATION

Evaluation Comparison

A. EVERGREEN SHRUBS	RATING %
Class I	
Picea pungens "dwarf"	100
Pinus mugo "dwarf"	100
Thuja orientalis pyramidalis	90
Class II	
Abies pungens "dwarf"	70
Juniperus horizontalis	80
Juniperus chinensis pfitzeriana aurea	70
Juniperus scopulorum "Blue Heaven"	80
Picea abies "dwarf"	70
Thuja orientalis globosa	80

EVERGREEN SHRUBS	RATING %
Class III	
Juniperus pfitzeriana	60
Juniperus sabina	60
Pinus mugo	60

B. DECIDUOUS SHRUBS	RATING %
Class II	
Acer ginnala	70
Caragana arborescens "Lorbergii"	75
Caragana arborescens pendula	80
Caragana pygmaea	70
Cornus alba cultivars	75
Euonymus nana	70
Hippophae rhamnoides (female)	75
Hydrangea	70
Lonicera coerulea edulis	70
Lonicera xylosteum (dwarf)	70
Lonicera korolkowii "Zabeli"	75
Philadelphus microphyllus	75
Potentilla fruticosa cultivars	70
Prunus t. multiplex	85
Prunus X cistena	70
Rose hybrids	75
Sambucus canadensis glauca	70
Sambucus racemosa aurea	70
Spiraea bumalda "Goldflame"	75
Syringa hybrids	85
Syringa josiflexa	70
Syringa prestoniae	70
Class III	
Amelanchier alnifolia	60
Caragana frutex globosa	65
Cornus alternifolia	60
Euonymus alata	60
Lonicera tatarica cultivars	60
Physocarpus opulifolius	60
Physocarpus o. luteus	68
Physocarpus o. nanus	63
Prunus fruticosa	55
Prunus japonica	65
Prunus tenella	63
Prunus tomentosa	67
Ribes aureum	65
Sambucus canadensis	60
Sambucus racemosa	62
Sambucus racemosa cultivars	67
Spiraea media	60
Spiraea trichocarpa	60
Spiraea triloba	55
Spiraea bumalda froebelii	65
Syringa vulgaris	60
Viburnum lantana	70
Viburnum lentago	75
Viburnum opulus	70
Viburnum opulus cultivars	70
Viburnum trilobum	60
Viburnum trilobum cultivars	70

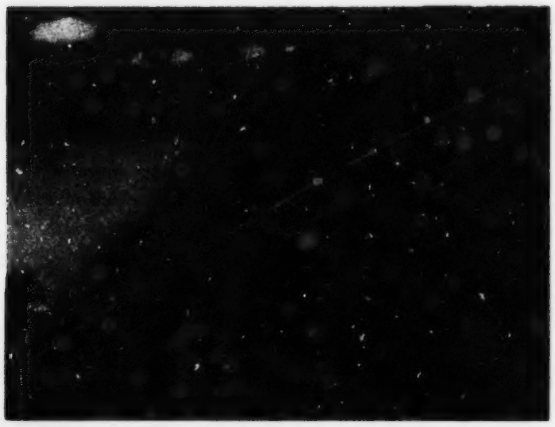
TABLE 10 (continued)

DECIDUOUS SHRUBS	RATING %
Class IV	
Caragana arborescens	40
Cornus sericea	50
Hippophae rhamnoides (male)	50
Lonicera tatarica	50
Potentilla fruticosa	50
Prunus besseyi	50
Ribes alpinum	50
Ribes missouriensis	40
Rosa acicularis	30
Rosa rubrifolia	50
Shepherdia argentea	40
Syringa villosa	50

SECTION TWO — WINDBREAK, SHELTERBELT EVALUATION FOR ALBERTA

Trees and shrubs planted for windbreak purposes on the Great Plains have a very important economic and aesthetic impact, therefore using the cost of establishment and benefits derived and compounded through the years is not realistic. A more realistic value needs to be placed on our tree plantings to receive the respect they deserve. A tree with the average life of 100 years destroyed at 50 years of age just cannot be replaced. As age is such an important factor there are two alternatives recommended.

For a belt up to 15 years of age the "Establishment Value" is realistic. This seems practical as most young shelterbelts can be replaced in a reasonably short time to provide comparable protection. The younger shelterbelts should be valued by determining the establishment cost, plus cost of annual crop loss, taxes, and other fixed costs of maintaining the land in trees.



A high value is placed on windbreak trees such as the ones shown.

1. Establishment Value

Includes costs of land preparation, planting, cultivation and other maintenance for the first 5 years for *all types* of plantings.

A cost of $1250 + (.22 x 1250) (1985$) is estimated for establishing a stand of 1000 trees per hectare. A 4% (.22) interest adjustment is made for 5 years. It includes preparation costs, planting costs, maintenance for the first 5 years (estimated to be establishment time.) The cost is then $1.53 per tree.

2. Protection Value

Used when croplands are being protected; a value for the crop is needed. Includes present and future benefits to agricultural crops in terms of net yield increase owing to reduced wind and evaporation. Some assumptions concerning average crop yield and value are necessary to arrive at a monetary value for cropland protection.

To be properly evaluated, the windbreak or shelterbelt must be viewed as a continuous integrated unit. The removal of a single tree or group of trees must be judged as to its effect on the total shelter loss, not on individual tree loss. A scattered group of trees along the fence line of a grain field could be more of a hindrance and removing them may be of benefit to the landowner.

The protected acreage is arrived at by multiplying the length (metres) of the belt by the distance (metres) to which protection extends on one side of the belt. The result is divided by 10,000 (square metres per hectare) to convert to number of hectares protected. The significant protection distance is the average height of tallest trees multiplied by 15.

Example:

Dense shelterbelt 0.8 km long and 12 m average height would protect 14.4 ha.

$$\text{i.e.} \quad \frac{800\text{ m} \times (12\text{ m} \times 15)}{10{,}000} = 14.4\text{ ha}$$

Since the average shelterbelt will grow into a different height class each 5 years over a 45 year life span, the calculation of protected area must be increased each 5 years.

Assumptions

The assumptions made to arrive at the basic field value had to be based on average situations. Alberta farmers follow a multi crop system with various crops being planted over the years. It would be an impossible task to value the crop on a year by year basis. The average prices were based on 1984 grain values and dollars.

EXAMPLE I — 15 year old belt at 7.5 m.

Age	Height (m)	Years	Protected Area for Each 0.1 km/ha	Year-Hectares
15	7.5 — 10.5	5	1.4	7.0
20	10.5 — 13.5	5	1.8	9.0
25	13.5 — 15.0	5	2.1	10.5
25-45	15+	20	2.6	52.0
		35		78.5

78.5-year hectares x $10.00 hectare per year. $785.00 for each 0.1 km segment appraised. (Protection Value)

EXAMPLE II— A 25 year old belt with an average height of 14 m.

Age	Height (m)	Years	Protected Area for Each 0.1 km/ha	Year-Hectares
25	13.5 — 15	5	2.1	10.5
25-45	Over 15	20	2.6	52.0
		25		62.5

62.5 year-hectares x $10.00 per hectare year = $625.00. (Protection Value)

Thus the younger windbreak has a higher protection value than the older windbreak because its protection value is increasing over a longer period of years. A planting already 25 years old can be expected to function for another 20 to 25 years at which time replacement must be made. A 45 year expected life span is average. On good moist land expected life span should be increased to 60 years.

These examples of protection value calculation are for shelterbelts of average or better density, uniformity and continuity. For windbreaks containing many gaps and openings throughout, or for rows of scattered trees the calculated value must be reduced by the number of openings or gaps, e.g., a windbreak with a 50% gap will be reduced in value by 50%.

To arrive at the value of native or natural windbreaks only the protection value is determined and reduced as required. Where native plants (trees/shrubs) are being removed, making homes less 'private', compute the protection value and increase by a factor of three. These will be plantings on the east or south of properties where no obvious wind protection is being afforded by the plants. This is a difficult calculation as no cost/benefit is lost with the loss of privacy.

Protection value for farmstead windbreaks (around the farm house and environs): Value should be five times that computed for a field shelterbelt.

Research has clearly shown that trees and other plants correctly located are energy-conserving, and provide a cooling effect in summer and a warming effect in winter. Trees positioned to function in this manner are worth more than the same plants situated elsewhere.

Windbreaks may be most effective when placed close to buildings, even though maximum wind speed reduction near ground level takes place about five heights downwind from the tree barrier. Basically, plants can be placed near buildings to control or guide wind by obstruction, deflection, and filtration.

EXAMPLE III — A 25 year old farmstead belt 13.5 - 15 m high would be worth $565.00 x 5 = $2825.00 for each 0.1 km segment.

The total value then is the sum of the establishment value and the protection value on a 0.1 km segment (assuming 470 trees per 0.1 km). For the 25 year old windbreak the value is $565.00 + (470 x 1.10) = $1082.00. A farmstead belt with the same number of trees then can be valued at 565 x 5 = 2825 + 517 = $3342.00.

MOST IMPORTANT: PROFESSIONAL JUDGMENT!

Net Value Increase of Protected Area

Basic value of $10/year-hectare protected can be applied to grain and similar annual crops. For forage or range crops, the value is reduced to $8/year-hectare. The basic value x .8 can be used.

Basic value adjustments:

Livestock feedlot areas are calculated at $40/year-hectare, or where concentrated quarters such as dairying are protected. Range livestock is based on $10/year-hectare. The basic value x 4 can be used.

Farmstead protection value where buildings and the home are protected is assigned a $50/year-hectare value or x 5 the basic field value.

It has been shown that farm homes and buildings can reduce the heating and cooling cost by 40% with the proper use of trees for windbreaks and shelter.

Where there are two or more possible values that could be used, the higher value is to be used.

Life Expectancy of Shelterbelt Trees

In the multirow belt, the longest lived tree is adjudged to be the effective life of the total belt.

TABLE 1
LIFE EXPECTANCY OF TREES PLANTED IN ALBERTA'S SHELTERBELTS

	Ave. Age	Value
Hedgeplants	50 Years	1.1
Small Deciduous	65 years	1.3
Tall Deciduous		
— Poplar, Willow	30 years	.75
— Maple, Ash	60 years	1.2
— Oak	75 years	1.4
— Birch	40 years	.8
Coniferous Trees	65 years	1.3

Multi Row Factor

Wind and noise reduction can be equated to the number of rows. The wider the belt, the greater the reduction.

TABLE 2

	Value
Single Row	1.0
2 rows	1.3
3 rows	1.5
4 rows	1.65
5 rows	1.8

Tree Condition Overall Value

— Above average growth, regular cultivation, maintenance, pruning, thinning, tree replacement 1.0

— Average growth, structurally sound, occasional cultivation and pruning; some thinning and removal of dead and diseased trees 9

— Decadent and weakened tree growth, no pruning; dead and diseased branches evident 8

— No pruning, thinning or removal of dead and diseased branches and trees ..... .65

Design

To be effective, the windbreak must be properly designed and planted.

TABLE 3

	Value
Ideal design/planting	1.0 - 1.2
South or East planting	.8 - 1.0
Too close to or too far from buildings	.2 - .5

Time Adjustment

When destruction occurs and *a replacement is planted*, the time difference is adjusted. The time difference is the age of the destroyed trees less the age of the replacement.

Difference	Value
0 - 5 years	1.0
6 - 10	1.2
11 - 15	1.4
16 - 20	1.6
21 - 25	1.8
26 - 30	2.0
31 - 35	2.1
36 - 40	2.2
41 - 45	2.5
46 - 50	2.0
51 - 60	1.6
60 +	1.0

Example

A 3 row 15 metre high farmstead belt, planted in 1955, 1.2 km long, made up of caragana, maple and scotch pine. There is evidence of disease. The belt was well designed and planted on the north and east side with no major breaks or openings. The owner is a cereal grain farmer.

Age	Height	Years	Protected Area for Each 0.1 m/ha*	Year/Hectares
35	15 m	5	2.7 (1) (5 x 2.7)	13.5
35 - 45	over 15 m	10	3.2 (2) (10 x 3.2)	32.0
				45.5

The basic value then is 45.5 x $10/hectare/year or $455.00 for each .1 km segment. In this case, 1.2 km is being appraised. Therefore, $455.00 x 12 segments equals $5,460.00

Life Expectancy	Type of Belt Farmstead	Rows Multirows (3)	Tree Condition	Design
1.3	5	1.5	.8	1.0 x

— no replanting is being done.

$5,460.00 x 1.3 x 5 x 1.5 x .8 x 1.0 = $42,588.00

*The calculations are: (1) (1200 x (15 m x 15) ÷ 10.000) x .1
(2) (1200 x (17.5 m x 15) ÷ 10.000) x .1

SECTION THREE
NATURAL TREE AREAS, EXCLUDING NATIVE WINDBREAKS

There has been consideration given to the evaluation of native tree cover where there is no obvious shelter given or privacy reduced. The formula developed can be used to arrive at the actual value of trees that may have been destroyed or damaged, or are to be condemned because of land use change. All of the accrued costs are included; intrinsic or sentimental values are not considered. All values in 1985 dollars.

The formula considerations:

1. To include planting costs, (on 1800 trees/hectare) based on current wage rates and adjusted for the length of time the planting will take. Also to include land preparation.
2. Annual expenses and their amortization for the five year establishment period i.e. 4% (.04) used in this calculation or 2% (.22) for five years.
3. To provide for land preplanting rehabilitation. Mainly labor to remove dead or extensively damaged trees, it should include time to burn or dispose of windrows, etc.

$$V = P + (P \times C) + 5\frac{(E \times C)}{R} + L$$

V = Value of Natural Planting
P = Planting Costs, includes labor, trees and other costs as well as preplanting land preparation
C = Interest factor
5 = Number of years to establishment
E = Annual expenses, to include taxes, land investment charges, cultivation and other maintenance charges
R = Annual interest rate as a decimal, .04 (4%)
L = Land rehabilitation charges where needed

Example, using full formula, assume one hectare, five year establishment time for a native site replanted to variety of plants. No fencing (fencing would be added cost at current fencing rates).

P = $60.00 for planting/hectare
C = .22, interest factor for five years (4% per annum)
E = $55.45, average yearly costs

Machine work	29.00
Weed control	12.00
Taxes	2.45
Land investment value $300.00/hectare at 4%	12.00
Total	55.45

L = No value as oil company disposed of all debris

$$V = \$60.00 + \frac{(60 \times .22)}{13.20} + 5\frac{(55.45 \times .22)}{.04}$$

$$V = 60 + 13.20 + 1524.88$$

$$V = \$1598.08$$

To this value must be added the cost of the trees, which will vary according to the variety and source.

Using the shelterbelt establishment cost of (1250 x .22) + 1250 = $1525.00, one can arrive at a similar per hectare value. This can be used on smaller areas, the discrepancy increases with larger areas.

Appendix I
TREE RATINGS FOR ALBERTA

CLASS — SPECIAL — 110%

Acer platanoides, cultivars
Acer saccharinum, cultivars
Acer saccharum
Picea pungens, cultivars

CLASS NO. 1 — 100%

Abies balsamea
Abies lasiocarpa
Abies sibirica
Acer platanoides
Acer saccharinum
Aesculus glabra
Aesculus hippocastanum
Betula albo-sinensis
Betula verrucosa cultivars
Fraxinus americana
Fraxinus mandschurica
Fraxinus nigra and cultivars
Fraxinus pennsylvanica lanceolata and cultivars
Larix sibirica
Picea pungens
Pinus albicaulis
Pinus cembra
Pinus flexilis
Pinus strobus
Pinus sylvestris
Pseudotsuga menzies glauca
Quercus alba
Quercus macrocarpa
Quercus rubra/borealis
Syringa reticulata
Thuja occidentalis
Ulmus americana and cultivars

CLASS NO. 2A — 90%

Populus tremula erecta
Populus canescens "Tower"
Sorbus aucuparia cultivars
Tilia americana cultivars
Tilia cordata cultivars
Tilia flavescens "Dropmore"
Ulmus japonica cultivars

CLASS NO. 2 — 80%

Abies concolor
Acer ginnala
Betula papyrifera
Larix decidua
Malus cultivars
Phellodendron amurense
Picea abies
Picea glauca
**Populus species*
Prunus maacki
Pyrus ussuriensis
Salix alba sericea
Sorbus americana
Sorbus aucuparia
Sorbus decora
Sorbus scopulina
Tilia americana
Tilia cordata
Tilia mongolica
Ulmus japonica

CLASS NO. 3A — 70%

Populus x "Griffin"
Salix selections

CLASS NO. 3 — 60%

Acer tataricum
Alnus glutinosa
Alnus tenuifolia
Betula occidentalis
Elaeagnus angustifolia
Juglans cinerea
Juglans nigra
Larix laricina
Malus baccata
Ostrya virginiana
Pinus banksiana
Pinus contorta latifolia
Pinus ponderosa
Pinus resinosa
**Populus species*
**Populus hybrids*
Prunus nigra
Prunus padus
Prunus pensylvanica
Prunus virginiana "Schubert"
**Salix* species

CLASS NO. 4A — 50%

Acer negundo
Celtis occidentalis
Crataegus species
Juglans mandshurica
Picea mariana
**Populus hybrids*
Ulmus pumila
**Salix* species

*Range, because of number of species or hybrids.

Appendix II
DIAGNOSTIC FACTORS TO CONSIDER IN TREE APPRAISALS

I. Kind — Scientific Name _____

Common Name _____

1. Value depends on:
   - Site adaptability:
     Hardiness (zone)
     Tolerance to drought, storms, wind, ice, etc.
     Soil type, texture, structure, and pH
     Drainage
     Exposure
     Slope and grade extent
     Pollution adaptability
     Native to area
   - Positive characteristics:
     Durability
     Sturdy branching habit
     Important bark, foliage, flower, and fruit characteristics
     Required maintenance
   - Negative characteristics:
     Bad habits
     Susceptibility to insects and diseases
     Undesirable flowers and fruit
2. Age and life expectancy.

RATING PERCENTAGE 1 TO 110%

II. Size

1. Trees:
   — general
   — caliper of trunk
   — area of cross-section
   a) diameter squared x 0.7854
2. Multiple stem trees:
   — cross-section of largest trunk + 40 to 60% of combined total of other trunks. Specimens required to furnish same degree of shade.

RATING PERCENTAGE 1 TO 100%

III. Condition (See appendix III for chart)

1. General:
   - Very few are perfect specimens
   - Know typical characteristics of species or cultivar and relate to perfect specimen
   - What has been previous treatment?

     Excellent _____
     Good _____
     Poor _____

     Pruning
     Fertilization
     Spraying
     Cabling and bracing
     Tree injection
     Herbicide applications or other materials applied
   - Have significant changes been made to the environment?
     Grade changes; cuts and fills
     Changes in water table by flooding or drainage
     Pavement: how near, materials, when installed
     Utility wires in contact with tree
     Utility underground excavation: sewer, gas, electric lines
     Injury from guy wires or other supports
     Change in habitat: forest to open status
   - When and how planted?
     Soil cover around tree
     Water practices
2. Specifics:
   - Foliage:
     Abnormal appearance of leaves:
     Size
     Number
     Density
     Color
     Deficiency symptoms
     Wilting
     Prevalence of insects and diseases
   - Twigs:
     Annual twig growth
     Abnormal appearance of buds: color, shape, size
     Abnormal dropping of twigs
     Girdling
     Prevalence of insects and diseases
     Discoloration of bark and sapwood
   - Larger branches:
     Amount of dead wood
     Excessive pruning
     Rate of wound healing
     Prevalence of insects and diseases
     Borer and bark beetle damage
     Rots and fungi
     Cankers and lesions
     Wire, cable or rod damage
   - Trunk of tree:
     Structural weaknesses and physical defects:
     Splits and weak crotches
     Loose bark
     Sunken area in basal trunk
     Frost cracks and condition

Appendix II (continued)
DIAGNOSTIC FACTORS TO CONSIDER IN TREE APPRAISALS

Cavities:
Size, depth, extent, and condition
Previous treatment
Callus healing
Prevalence of old pruning wounds
Extent of healing
Prevalence of insects and diseases
Borers and fungi
Slim flux: origin, extent, and condition
Enlarged basal trunk
Graft incompatibility or other cause
Lightning injury and condition
Electrical burning from wires
Mechanical injuries
Prevalence of suckers or water sprouts
Extent of wood decay
Use increment borer to determine

- Roots:
Evidence of girdling roots at or below surface
Color of feeding rootlets
Extent and color
Mechanical injuries
Exposure due to soil removal and tunneling and trenching
Prevalence of insects and diseases
Cankers and crown rot
Methane gas in old land fill sites
- Condition of other plants in location of a similar kind.

RATING PERCENTAGE 1 TO 100%

IV. Location

1. General:
   - Residential, mall, park, street, arboretum, industrial, woodlot, etc.
   - Specifics: Specimen, foundation, screen hedge, windbreak, etc.
2. Design:
   - Does plant fit the requirements of the specific location?
   Size potential, habit, growth rate, etc.
   Architectural and engineering features:
   Space articulation, traffic control, etc.
   Balance and symmetry

Appendix III
TREE DIAGNOSIS AND CONDITION CHART

Factors to Consider	Check-off ratio (1-10)	Comments
General		
Is tree native to area		
Transplanted or natural		
Condition of other trees in area		
Foliage		
Abnormal appearance of leaves		
Size		
Number		
Color		
Deficiency symptoms		
Wilting		
Presence of insects and disease		
Twigs		
Annual twig growth		
Abnormal appearance of buds		
Color		
Size		
Discoloration of sapwood or streaking		
Prevalence of insects and disease		
Large Branches		
Amount of dead wood		
Excessive pruning		
Rate of wound healing		
Structural weakness		

Factors to Consider	Check-off ratio (1-10)	Comments
Trunk		
Splits or weak crotches		
Loose bark		
Sunken area in basal trunk		
Frost cracks		
Cavities		
Size		
Condition		
Callus healing		
Prevalence of insects and disease		
Lightning injury		
Mechanical		
Roots		
Girdling roots		
Color of feeding rootlets		
Exposure of cuts		
Gas or herbicide injury		
Soil		
Type		
pH		
Drainage		
Slope and grade		
Previous treatments		
Fertilization		
Pruning		
Spraying		
Cabling and bracing		

SUGGESTED READING LIST

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